(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING
Volume 4, No. 1, March 2021

P-ISSN 2621-4733
E-ISSN 2621-4741

https://dx.doi.org/10.22460/jiml.v4i1.p001-011

DEVELOPING STUDENT BOOK BASED ON ETHNOMATHEMATICS TO IMPROVE STUDENT'S CRITICAL THINKING SKILL

Irma Risdiyanti[1], Dwi Sulisworo[2]

[1]Master of Mathematics Education, Ahmad Dahlan University, Yogyakarta, Indonesia.
irma.risdiyanti28@gmail.com
[2]Master of Mathematics Education, Ahmad Dahlan University, Yogyakarta, Indonesia.
sulisworo@gmail.com

ARTICLE INFO

Article history:

Received Jan 19, 2021
Revised Feb 04, 2021
Accepted Feb 06, 2021

Keywords:

Student Book
Ethnomathematics
Critical Thinking
Multimedia Learning
Learning Innovation

ABSTRACT

The current world conditions have led to the life of the 21st century with all the very rapid changes in civilization and the challenges that future generations must face. So it is necessary to prepare students to have creative skills to adapt and face challenges in the 21st-century era. In the implementation of the 21st curriculum in Indonesia, it needs to be adapted to Indonesia's existing context. In alternative mathematics learning, an approach that can be used is PMRI (*Pendidikan Matematika Realistik Indonesia* or Indonesian Realistic Mathematics Education) with the context of Ethnomathematics. This study aims to develop ethnomathematics-based multimedia to support the development of PMRI-based learning using the ethnomathematics context. The method used in this research is design research with the type of development studies. The data collection technique was done by interviewing, distributing questionnaires, and studying literature. The data were then analyzed using a qualitative descriptive analysis. The results of this study are a student book product and the results of the analysis of student responses to these products. This research is expected to become a foundation in developing mathematics learning designs using ethnomathematics contexts to improve student critical abilities.

Corresponding Author:

Irma Risdiyanti,
Master of Mathematics Education,
Ahmad Dahlan University,
Jl. Pramuka 42, Pandeyan, Umbulharjo, Yogyakarta 55161,
Email: irma.risidyanti28@gmail.com

How to Cite:

Risdiyanti, I., Sulisworo, D. (2021). Developing Student Book based on Etnomathematics to Improve Student's Critical Thinking Skill. *JIML*, 4(1), 1-11.

INTRODUCTION

Today's world has begun to lead to the life of the 21st century, marked by the increasingly rapid development of technology, faster computing, automation replaces human work, and information can be accessed anywhere and anytime (Rotherdam & Willingham, 2009). Changes in human life in this century are a challenge for future generations. Future jobs are difficult to predict, such as current jobs will be lost in the next 10 to 20 years, and new jobs that will exist in the future are not thought of at this time (Mahanani, 2018). Thus, future generations must be prepared and be more creative and critical to adapt to change (Bellanca,

2010; Malik, 2018). The 21st Century curriculum is designed to prepare students in the 21st-century era with several competencies that must be possessed to face the challenges of life in that era (Boyatzis, 2008; Salpeter, 2003). There are four competencies in the curriculum, one of which is the ability to critical thinking. This ability is important to see the difficulty of change, and civilization is predicted in the future so that students must have critical thinking to be adaptive to changes in the future (Alismail & McGuire, 2015).

Besides, one part of the student learning section is developing and applying mathematical concepts based on problems in everyday life (Tanujaya, et al., 2017; Wahyu, et al., 2017). This is also presented by Freudhental (1991), which states that mathematics is a human activity and mathematics must have a human life. The rational reason of society that mathematics does not exist in everyday life and there is no consideration with culture starts from students who do not know how to use mathematics to solve daily problems (Karnilah, 2013; Putra, et al., 2017). So, this makes people less able to feel the benefits of learning mathematics. Based on the PISA results (Program for International Student Assessment) study analyzed by Stacey (2011), it shows that Indonesian students are less able to use mathematical concepts to solve problems related to everyday life. Students have not been able to use mathematical concepts in solving daily problems because teachers in the learning process at school have not yet connected mathematics with culture and daily activities (Arisetyawan, et al. 2014; Widodo, et al. 2017; Nurhasanah, et al. 2017) this causes researchers to try to find a formula in teaching mathematics that is close to human activities. Abdullah (2016) states that in learning mathematics, a bridge connecting mathematics with culture and everyday life is ethnomathematics. D'Ambrosio (1985)) explains that ethnomathematics' purpose is to do mathematics differently by considering the development of academic knowledge in different cultural sectors and societies. Besides, Freudenthal (1973) also began to develop a learning approach that is close to human life, namely the approach of realistic mathematics.

In Indonesia, this curriculum must be adapted to the existing context, such as culture and students' daily lives, to understand the material provided, and competence can be achieved (Malik, 2018). One approach that can be used in mathematics learning is the PMRI (*Pendidikan Matematika Realistik Indonesia* or Indonesian Realistic Mathematics Education) approach (Sembiring, 2010; Ekawati & Kohar, 2016; Fauziah & Putri, 2018). This approach is an adaptation of RME (Realistic Mathematics Education) developed by Freudhental in the Netherland. The characteristic of PMRI is to use real context as a starting point in learning (Sembiring, Hadi & Dolk, 2008; Putri, Dolk & Zulkardi, 2015). One of the real contexts that can be used is ethnomathematics or a cultural context that contains mathematical concepts (Risdiyanti & Prahmana, 2087). So far, mathematics is still seen as a science far from culture and daily life because most teachers teach mathematics, only given definite formulas that are not related to students' culture and daily lives (Prahmana & Kusumah, 2016). Where as in the 21st-century curriculum competence, it is emphasized to contribute and solve problems in real life (Riyanti & Suparman, 2019). The context of ethnomathematics can bridge mathematics with culture and students' daily lives so that students can easily understand the material, take the meaning of the knowledge learned, and contribute and solve real-life problems (Risdiyanti, Prahmana & Shahrill, 2019).

Several previous studies have proven that learning using the PMRI or RME approach can improve critical thinking skills, including Primasari (2016) research on PMRI and Inquiry as an alternative to learning to improve critical thinking and problem-solving skills; Indira, Somakin & Susanty (2018) regarding the Critical Thinking Ability of Junior High School Students through the Indonesian Realistic Mathematics Education Approach; Sholilah & Rejeki (2020) regarding Improving Critical Thinking Ability through the Application of the

Indonesian Realistic Mathematics Education (PMRI) Approach to Association Learning; Suci, Firman, & Neviyarni (2019) regarding Improving Students' Critical Thinking Skills Through Realistic Approaches in Primary Schools; Hasratuddin (2010) regarding the improvement of critical thinking skills of junior high school students through a realistic mathematics approach. However, in previous studies, no one has developed student book based PMRI using the context of ethnomathematics.

Indonesia's conditions are currently in the era of the Covid-19 pandemic, where learning is carried out online (Arifa, 2020). In this minimal face-to-face distance learning, Students usually tend to feel bored, and their motivation to learn decreases (Gani, 2020; Kurniasari, 2020). To solve this problem, we need a media that can support learning and can attract students. In learning, the media has an important role in distributing material so that it can stimulate thoughts, feelings, attention, and interests and attention of students so that the learning process occurs (Ellsworth, 2005; Mayer, 2005; Jenkins, 2009). Besides, multimedia also has benefits, including understanding deeper, increasing problem-solving skills, increasing positive emotions, and accessing various information (Sulisworo & Suryani, 2014; Mayer, 2002). Psychologically, experiencing multimedia learning in mathematics learning can also increase students' learning interest and interest and reduce the level of stories and students when learning mathematics. With multimedia that uses real contexts and is close to students' daily lives, it can answer the psychological needs of children who tend to find it easier to learn something starting from a real form and then drawn into a formal mathematical concept and can be used by students without the help of real contexts. Some of these benefits can support the improvement of students 'critical thinking skills needed to face the challenges of the 21st century (Jenkins, 2009). Therefore, this study aim to develops a student book based PMRI using gunungan wayang as ethnomathematics contexts to improve students' critical thinking skills. This research was then used as one of the basic parts to support the development of PMRI-based learning designs with an ethnomathematics context.

METHOD

This study uses a design research method with the type of development studies. There are two stages in this type of design research: preliminary evaluation and formative evaluation. The preliminary evaluation stage is conducted to analyze the problem and design a solution to the problem. Meanwhile, the formative evaluation stage is carried out by evaluating the solutions that have been designed (Prahmana, 2017). This study uses a design research method with the type of development studies (Prahmana, 2017; Freangkel, Wallen & Hyun, 1993). There are two stages in this type of design research: preliminary evaluation and formative evaluation. The preliminary evaluation stage is conducted to analyze the problem and design a solution to the problem. Meanwhile, the formative evaluation stage is carried out by evaluating the solutions that have been designed (Freangkel, Wallen & Hyun, 1993; Heriyadi & Prahmana, 2020). Data collection techniques were carried out by conducting interviews, distributing questionnaires, and studying literature. Then the data were analyzed using qualitative descriptive analysis. The design of this research can be seen in the figure 1:

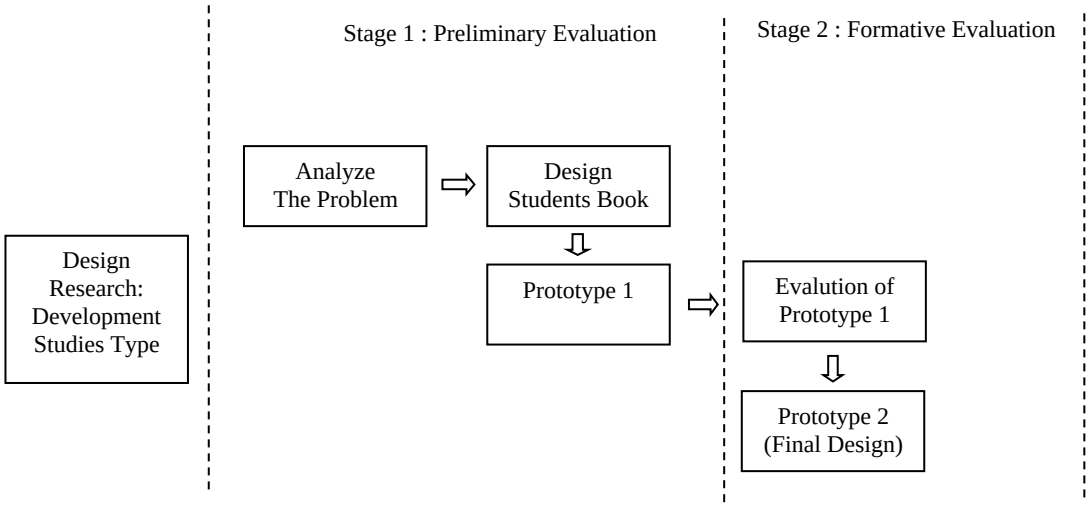

Figure 1. Design Research of Development Studies Type

RESULTS AND DISCUSSION

In the preliminary evaluation stage, before to design a student book product, the researcher analyzes several important aspects of student book design, including student characteristics, material, competencies to be achieved and strategis. The results of the analysis are as follow:

1. Analysis of the characteristics of students

Based on the research results, it can be seen that the critical thinking skills of students have been seen but have not been developed properly and optimally. Learning in schools also has not connected mathematical concepts with the real context around students, so students cannot critically connect and use mathematical concepts to solve problems around students. Multimedia in mathematics learning in schools has not been maximized to affect student interest and student interest in learning mathematics. Based on these savings, it can be concluded that it is necessary to develop multimedia based on realistic mathematics with an ethnomathematics context to improve students' critical thinking skills.The results should be clear and concise. The results should summarize (scientific) findings rather than providing data in great detail. Please highlight differences between your results or findings and the previous publications by other researchers.

2. Analyis of Learning Material and Learning Competences

The learning competencies used in schools refer to the competencies in the 2013 curriculum. The research material chosen is material about the concept of symmetry with basic competencies, namely explaining cockroach symmetry and rotational symmetry in flat shapes using concrete objects, identifying folding symmetry, and rotating symmetry in flat shapes using concrete objects (Kemendikbud, 2016). The indicator that must be achieved is identifying a shape that has fold symmetry correctly and determining the number of fold symmetry in shape correctly (Boyatzis, 2008; Ennis, 1985).

3. Analyis of Learning Material and Learning Competences

One approach to learning mathematics that can be used is the Indonesian Realistic Mathematics Education (PMRI) approach to improve critical thinking skills and bridge mathematical concepts with students' daily lives and culture. This approach is an adaptation of Realistic Mathematics Education (RME) developed by Freudhental in the Netherland, The

Netherlands. The PMRI character uses real context as a starting point in learning (Sembiring, 2010; Ekawati & Kohar, 2010; Fauziah & Putri, 2017). The real context used is ethnomathematics or cultural context, which contains mathematical concepts (Ennis, 1985, Risdiyanti & Prahmana, 2020). So far, mathematic is still seen as a science far from culture and everyday life because most teachers teaching mathematics are only given a definite formula not served by students' culture and daily lives (Van den Heuvel-Panhuizen & Drijvers, 2020). The-century curriculum is written to contribute and be a solution to solve problems in real life (Frydenberg & And one, 2011). The context of ethnomathematics can bridge mathematics with culture and students' daily lives to understand the material, make meaning of the knowledge learned, and contribute and solve real-life problems (D'Ambrosio, 2001; Rosa & Orey, 2011).

Based on several analyses, an ethnomathematics-based learning student book design is then created to improve students' critical abilities. The student book that is developed is tailored to the needs of the developed learning. The design of student book can be seen in figure 2.

Figure 2. The Design of Student Book using Gunungan Wayang Context

Figure 2 is a design drawing from a student book on symmetrical learning using the context of the Gunungan wayang. In the student book's design, a cover and a less formal font choice were used to attract the attention and relaxed feeling of students in learning mathematics. Then the students were induced to learn more about the context used. In the student's book design, the students were induced to understand more deeply the context of the Gunungan in the Indonesian wayang. After students understand and understand the context used in the student book, they are guided to see the Gunungan and identify its shape. Students are guided to see the Gunungan wayang from the left and right sides to introduce the symmetrical concept, whether they have the same shape. Students then display their opinions in the column provided. Furthermore, students are guided to redraw the Gunungan Wayang in their own way and are directed to a formal understanding of the symmetrical concept. The principles used in developing student books follow the principles in Indonesian Realistic Mathematics Education, namely, learning begins with a real context as a beginning in learning. Student activities in this student book start from concrete activities, activities that still use context in learning and introduction to context recognition; mode of activity which learning activities begin to understand mathematical concepts using context; mode for which begins to lead to mathematical concepts, and context has begun to be released. The final activity is formal knowledge, where students have been able to use and understand mathematical concepts formally without context.

The book design is then evaluated by responding to several students through interviews and distributing questionnaires. The result was that 90% of students stated that they were interested in using student books with an ethnomathematics context in the form of Gunungan Wayang, 98% of students felt that these student books made it easier for students to understand symmetrical concepts, 96% of students stated that when using an ethnomathematics context students felt that mathematics became with life. Every day and close to student culture, 100% of students said students could take meaning from the cultural context and mathematical concepts learned. Lastly, 100% of students said they felt motivated to learn mathematics further. So it can be denied that students are interested in student books that use the context of the Gunungan Wayang and find it easier to understand mathematics and become motivated to learn mathematics. This study's results are expected to be used for the next stage of research, namely formative evaluation, and be used as a basis for designing learning designs using the context of Gunungan Wayang.

This study's results take a role, namely, to add treasures or references to multimedia development using the ethnomathematics context. Several previous studies include the development of ethnomathematics-based mathematics learning media 'Madura smart math' (Efendi, 2018); Development of Pocket Book of Transformation Geometry with Nusantara Batik Motif (Muslimah, 2018); Development of Vocational School Mathematics Teaching Materials based on Geometers Sketchpad Software with an Ethnomathematics Approach (Masduki & Nurmawati, 2013); Development of Timor Weaving Ethnomatic Mathematics-based Student Worksheets on Number Patterns (Disnawati & Nahak, 2019); Development of Digital Comics (EDC) as a Learning Media to Improve Mathematical Literacy and Character Education in Primary Education Aged Children (Nisa, 2019); Development of Ethnomathematics-Based Two-Dimensional Subject Modules for Class IV Elementary School Students (Triwahyuningtyas, Mahmuda & Yulianti (2020).

Regarding Indonesia's education policy towards mathematics learning with a realistic mathematics education approach using an ethnomathematics context, the government has actually been open to the latest innovations in learning design. This is evidenced by the encouragement of research and collaboration with universities and educational organizations at home and abroad regarding innovation in mathematics learning design in the context of

ethnomathematics (Prabowo & Sidi, 2010). The 2013 curriculum has not been clearly written using realistic mathematics and using the context of ethnomathematics, but the 2013 curriculum has stated that learning mathematics uses a real context and is close to the daily lives of students (Richardo, 2017). This can be in line with the concept of Indonesian realistic mathematics education and ethnomathematics. In the 2013 curriculum, teachers are also innovative to be more creative and creative in learning mathematics so that students can take meaning and can use mathematics to solve problems in students' daily lives (Alawiyah, 2013).

Besides, the world today has begun to lead to the life of the 21st century, a crisis where technology is growing rapidly, the speed of computing, automation of human work, and information can be accessed anywhere and anytime (Willingham, 2009). Changes in human life in this century are a challenge to create a future. Future jobs are difficult to predict, such as current jobs will be lost in the next 10 to 20 years, and new jobs that will exist in the future are not thought of at this time (Mahanani, 2018). Thus, future generations must be prepared and be more creative to adapt to changes (Bellanca, 2010). In addition to the 2013 curriculum used in Indonesia today, the 21st-century curriculum used by several countries today is also designed to prepare students in the 21st-century era with several competencies that must be possessed to face life's challenges in that era (Boyatzis, 2008). Realistic mathematics learning with an ethnomathematics context is in line with the ideals of the 21st-century curriculum, which prepares students to face and use the knowledge they learn to answer the challenges of 21st-century life.

Mathematics education that is innovative, realistic, and close to everyday life does answer the challenges of the 21st century and the challenges of learning during the covid 19 periods. During this pandemic, teachers are required to be more creative in providing mathematics learning. This is because the student learning process, the development of students' thinking, and students' mental condition are greatly helped by the way the mathematics teacher learns courageously. In fact, many students experience boredom and decreased motivation to learn because the learning carried out by teachers is less innovative, creative, and less connected to students' context and daily lives, so that students do not get meaning from the knowledge they learn (Rahmi, 2020; Kurniasari, 2020). Therefore, this research is one of the innovations and solutions for learning mathematics during the pandemic so that students do not experience burnout and decrease learning motivation.

Several schools in Indonesia have also attempted to open up and implement mathematics education in schools using ethnomathematics. This is evidenced by several implementations in several schools written in scientific papers, including the Implementation of Realistic Mathematics Learning based on Ethno-Mathematics (Irawan & Kencanaawaty, 2017); Implementation of Ethnomatic Mathematics for the Indigenous Children (SAD) of Batanghari Regency, Jambi Province in Mathematics Learning (Muslimahayati & Wardani, 2019); Implementation of Local Culture-Based Ethnomatics in Mathematics Learning at the Elementary School Level (Putra & Indriani, 2017); Implementation of Ethnomatematics in Mathematics Learning in Primary Schools (Purwoko, 2017); Implementation of Ethnomatematics Using Traditional Games on Class IV Flat Building Materials SDN Punten 01 Kota Batu (Khoirudin, 2020); Implementation of Patil Lele Traditional Games as Ethnomatematics to Improve Students' Views of Mathematics (Rahmawati, 2019); Implementation of Sasak Cultural Ethnomatematics (Rumah Adat Sembalun) Against Student Interest in Mathematics Subjects SDN 02 Sembalun Bumbung (Dewi, 2018).

So far, not many teachers have developed student books using the PMRI approach and the ethnomathematics context. So that this research has a high novelty and originality and has quite important benefits to answer the various challenges of 21st-century life, learning challenges during the epidemic period, and also answering various problems in mathematics

education which have been teaching without context with students' daily contexts so that students are less can take meaning and can not use mathematics in the daily life of students. This innovation also contributes to improving students' understanding of mathematical concepts in a complete and accessible way in everyday life. When a PISA or TIMMS test is carried out, students understand the concept completely and have connected it and used it with daily problems. This research will not only stop here, but this research is part of the design development of PMRI-based mathematics learning design using the context of ethnomathematics. The student book is a guidebook to guide each student's activity in mathematics learning. The teacher acts as a facilitator who guides students in carrying out the activities in the student book. The hope is that students can understand the symmetrical concept thoroughly using their own thinking strategies and understand and learn about the culture and values implied in the context used. With this student book, it is hoped that knowledge will bring benefits to solve various problems in students' daily lives related to the symmetric concept. Researchers also hope that with the openness of the education policy in Indonesia and the paradigm of researchers and teachers, mathematics learning innovations using a realistic approach to Indonesian mathematics and ethnomathematics can develop and be used as a role in mathematics learning throughout Indonesia.

CONCLUSION

In the study, the analysis results were obtained regarding several important aspects of student book development: student characteristics, material, competence, and learning strategies. Based on the analysis results, and ethnomathematics based student book design was developed to improve students' critical thinking skills. This depends on the needs of the learning design to be developed. Hopefully, this study's results can support future research on developing PMRI-based learning designs using ethnomathematics context.

REFERENCES

Abdullah, A.S.(2016). Ethnomathematics in Perspective of Sundanese Culture.Journal on Mathematics Education, 8(1), 1-16.

Alismail, H. A., & McGuire, P. (2015). 21st century standards and curriculum: Current research and practice. Journal of Education and Practice, 6(6), 150-154.

Arifa, F. N. (2020). Tantangan Pelaksanaan Kebijakan Belajar Dari Rumah Dalam Masa Darurat Covid-19. Info Singkat; Kajian Singkat Terhadap Isu Aktual Dan Strategis, XII (7/I), 6. Jurnal Bidang Kesejahteraan Sosial, 12.

Arisetyawan, A., Suryadi, D., Herman, T., Rahmat,C., & No, J.D.S.(2014). Study of Ethnomathematics: A Lesson From the Baduy Culture.International Journal of Education and Research,2(10), 681-668.

Bellanca, J. A. (Ed.). (2010). 21st century skills: Rethinking how students learn. Solution Tree Press.

Boyatzis, R., & Boyatzis, R. E. (2008). Competencies in the 21st century. Journal of management development.

Boyatzis, R., & Boyatzis, R. E. (2008). Competencies in the 21st century. Journal of management development.

D'Ambrosio, U. (1985).Ethnomathematics and its Place in the History and Pedagogy of Mathematics.For the Learning of Mathematics,5(1), 44-48.

D'Ambrosio, U. (2016). An overview of the history of ethnomathematics. In Current and future perspectives of ethnomathematics as a program (pp. 5-10). Springer, Cham.

d'Ambrosio, U. (2001). What is ethnomathematics, and how can it help children in schools?. Teaching children mathematics, 7(6), 308-308.

Ekawati, R., & Kohar, A. W. (2017). Innovative teacher professional development within PMRI in Indonesia. International Journal of Innovation in Science and Mathematics Education (formerly CAL-laborate International), 24(5).

Ellsworth, E. (2005). Places of learning: Media, architecture, pedagogy. Routledge.

Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. Educational leadership, 43(2), 44-48.

Fauziah, A., & Putri, R. I. I. (2017). Primary school student teachers' perception to Pendidikan Matematika Realistik Indonesia (PMRI) instruction. JPhCS, 943(1), 012044.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (1993). How to design and evaluate research in education (Vol. 7). New York: McGraw-Hill.

Freudenthal, H. (1973). Mathematics as an Educational Task. Dordrecht: Kluwer Academic Publishers.

Frydenberg, M., & Andone, D. (2011, June). Learning for 21st century skills. In International Conference on Information Society (i-Society 2011) (pp. 314-318). IEEE.

Gani, T. A., Wahyuni, P., & Fahrina, A. (Eds.). (2020). Antologi dari Bumi Paguntaka: Covid-19: Dampak dan Solusi. Syiah Kuala University Press.

Hasratuddin, H. (2010). Meningkatkan kemampuan berpikir kritis siswa smp melalui pendekatan matematika realistik. Jurnal Pendidikan Matematika, 4(2), 19-33.

Heriyadi, H., & Prahmana, R. C. I. (2020). PENGEMBANGAN LEMBAR KEGIATAN SISWA MENGGUNAKAN PENDEKATAN PENDIDIKAN MATEMATIKA REALISTIK. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 9(2), 395-412.

Indira, T., Somakim, S., & Susanty, E. (2018). Kemampuan Berpikir Kritis Siswa SMP melalui Pendekatan Pendidikan Matematika Realistik Indonesia. Histogram, 1(2).

Jenkins, H. (2009). Confronting the challenges of participatory culture: Media education for the 21st century (p. 145). The MIT Press.

Karnilah, N. (2013). Study Etnomathematics: Pengungkapan Sistem Bilangan Masyarakat Adat Baduy.Disertasi. Bandung: Universitas Pendidikan Indonesia.

Kementerian Pendidikan dan Kebudayaan (2016). Buku Guru Kelas IV SD. Jakarta: Kemendikud.

Kementerian Pendidikan dan Kebudayaan (2016). Buku Siswa Kelas IV SD. Jakarta: Kemendikud.

Kurniasari, A., Pribowo, F. S. P., & Putra, D. A. (2020). Analisis Efektivitas Pelaksanaan Belajar Dari Rumah (Bdr) Selama Pandemi Covid-19. Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan Dan Hasil Penelitian, 6(3), 246-253.

Kwon, J. W and Kim, S.D. (2014). Characterization of an antibiotic produced by bacillus subtilis JW-1 that suppresses Ralstonia solanacearum. J. Microbiol. Biotechnol. 24(1): 13-18, http://dx.doi.org/10.4014/jmb.1308.08060.

Mahanani, P. (2018, December). Analysis of Challenges and Needs of Generation Behavior in 21st Century. In International Conference on Education and Technology (ICET 2018). Atlantis Press.

Malik, R. S. (2018). Educational challenges in 21st century and sustainable development. Journal of Sustainable Development Education and Research, 2(1), 9-20.

Malik, R. S. (2018). Educational challenges in 21st century and sustainable development. Journal of Sustainable Development Education and Research, 2(1), 9-20.

Mayer, R., & Mayer, R. E. (Eds.). (2005). The Cambridge handbook of multimedia learning. Cambridge university press.

Mayer, Richard E. "Multimedia learning." Psychology of learning and motivation. Vol. 41. Academic Press, 2002. 85-139.

Nurhasanah, F., Kusumah, Y.S., & Sabandar, J. (2017). Concept of Triangle: Examples of Mathematical Abstraction in Two Different Contexts. International Journal on Emerging Mathematics Education, 1(1), 53-70

O'Brien, P., Revaprasadu, N. (2013). Solid-State Materials, Including Ceramics and Minerals. In Reedijk, J., Poeppelmeier, K. (eds.), Comprehensive Inorganic Chemistry II, 2nd ed. Elsevier. United states. pp.xxii-xxiv.

Prahmana, R. C. I. (2017). Design research (Teori dan implementasinya: Suatu pengantar). Yogyakarta: Rajawali Press.

Prahmana, R. C. I., & Kusumah, Y. S. (2016). The hypothetical learning trajectory on research in mathematics education using research-based learning. Pedagogika, 123(3).

Primasari, N. P. D. (2016, June). PMRI DAN INKUIRI SEBAGAI ALTERNATIF PEMBELAJARAN UNTUK MENINGKATKAN KEMAMPUAN BERPIKIR KRITIS DAN PEMECAHAN MASALAH. In Prosiding Seminar Nasional MIPA.

Putra, H.D., Herman, T., & Sumarmo, U. (2017). Development of Student Worksheets to Improve the Ability of Mathematical Problem Posing. International Journal on Emerging Mathematics Education, 1(1), 1-10.

Putri, R. I. I., & Dolk, M. (2015). Professional Development of PMRI Teachers for Introducing Social Norms. Indonesian Mathematical Society Journal on Mathematics Education, 6(1), 11-19.

Risdiyanti, I., & Prahmana, R. C. I. (2017, December). Ethnomathematics: Exploration in javanese culture. In Journal of Physics: Conference Series (Vol. 943, No. 1, p. 012032). IOP Publishing.

Risdiyanti, I., & Prahmana, R. C. I. (2017, December). Ethnomathematics: Exploration in javanese culture. In Journal of Physics: Conference Series (Vol. 943, No. 1, p. 012032). IOP Publishing.

Risdiyanti, I., & Prahmana, R. C. I. (2020). Ethnomathematics Teori dan Implementasinya-Suatu Pengantar. UAD PRESS.

Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. Elementary Education Online, 18(4).

Riyati, I., & Suparman, S. (2019). Design student worksheets based on problem-learning to enhance mathematical communication. Asian Journal of Assessment in Teaching and Learning, 9(2), 9-17.

Rosa, Milton, and Daniel Clark Orey. "Ethnomodeling: a pedagogical action for uncovering ethnomathematical practices." Journal of Mathematical Modelling and Application 1.3 (2011): 58-67.Madigan, M.T., Martinko, J.M., Stahl, D.A.,Clark, D.P. (2010). Brock Biology of Microorganisms, 13th ed. Benjamin Cummings. San Francisco. pp. 42-59.

Rotherham, A. J., & Willingham, D. (2009). 21st century. Educational leadership, 67(1), 16-21.

Salpeter, J. (2003). 21st century skills: Will our students be prepared?. TECHNOLOGY AND LEARNING-DAYTON-, 24(3), 17-29.

Sembiring, R. K. (2010). Pendidikan Matematika Realistik Indonesia (PMRI): Perkembangan dan Tantangannya. Journal on Mathematics Education, 1(1), 11-16.

Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. ZDM, 40(6), 927-939.

Sholihah, I., & Rejeki, S. (2020). Peningkatan Kemampuan Berpikir Kritis melalui Penerapan Pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) pada Pembelajaran Himpunan. Kontinu: Jurnal Penelitian Didaktik Matematika, 4(1), 1-16.

Stacey, K. (2011). The PISA View of Mathematical Literacy in Indonesia.Journal on Mathematics Education, 2(1), 95-126.

Suci, D. W., Firman, F., & Neviyarni, N. (2019). Peningkatan Keterampilan Berpikir Kritis Siswa Melalui Pendekatan Realistik di Sekolah Dasar. Jurnal Basicedu, 3(4), 2042-2049.

Sulisworo, D., & Suryani, F. (2014). The effect of cooperative learning, motivation and information technology literacy to achievement. International Journal of Learning & Development, 4(2), 58-64.

Tanujaya,B., Prahmana,R.C.I., & Mumu, J. (2017). Mathematics instruction, Problems, Challenges, and Opportunities: A Case Study in Manokwari Regency, Indonesia.World Transactions on Engineering and Technology Education, 15(3), 287-291.

Van den Heuvel-Panhuizen, M., & Drijvers, P. (2020). Realistic mathematics education. Encyclopedia of mathematics education, 713-717.

Wahyu, K., Amin, S.M., & Lukito, A. (2017). Motivation Cards to Support Students'understanding on Fraction Division. International Journal on Emerging Mathematics Education, 1(1), 99-120.

Widodo, S.A., Purnami, A.S., & Prahmana, R.C.I. (2017). Team Accelerated Instruction, Initials and Problem-solves Ability in Junior high School. International Journal on Emerging Mathematics Education, 1(2), 193-204.